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Heart Failure

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Heart failure is characterized by inability of the heart to deliver oxygen to the tissues at a rate commensurate with oxygen demand. With mild cardiac failure, the deficit occurs only during physical activity; when severe, it may exist even at rest. The prevalence of heart failure increases exponentially with age (1), with an eightfold increase among men in the seventh as compared with the fifth decade in the Framingham population (2). At all ages men have higher rates of heart failure than do women, but this condition is both overdiagnosed and underdiagnosed. The prognosis is poor, with less than half the patients surviving 5 years after the diagnosis of heart failure and fewer than 50% of patients in New York Heart Association class IV surviving for 1 year (1).

Etiology

The most common causes of heart failure in an elderly population are ischemic heart disease and hypertension. Another common cause is valvular heart disease, especially calcific aortic valve disease; cardiomyopathy, particularly amyloid heart disease, is a less frequent cause.

Specific factors precipitating heart failure are more common and important in the elderly patient (3), mandating attention to their detection and correction. Bradyarrhythmias or tachyarrhythmias, particularly atrial fibrillation with loss of the atrial contribution to ventricular filling and complete atrioventricular (AV) block, are often implicated. Heart failure may be precipitated by myocardial infarction (4), acute valvular regurgitation, anemia, infection and fever, hyper- or hypothyroidism, renal insufficiency, dietary sodium excess, alcohol abuse, fluid overload, the administration of drugs that depress myocardial function (beta- or calcium blockers) or promote sodium retention (nonsteroidal anti-inflammatory drugs) or the patient's inability to follow prescribed therapy because of economic constraints.

Pathophysiology

The most common pathophysiologic abnormality underlying heart failure is ventricular systolic dysfunction, which is characterized by a decreased ejection fraction. In the elderly patient without cardiac enlargement, diastolic dysfunction may predominate, particularly when hypertension, hypertrophic cardiomyopathy or other causes for left ventricular hypertrophy are present (5,6). Decreased ventricular compliance and elevation of the pulmonary capillary pressure often produce pulmonary congestion (7). The left ventricular ejection fraction may be normal or slightly decreased in these patients with left ventricular diastolic dysfunction, pulmonary hypertension and heart failure. The prognosis of elderly patients with congestive heart failure due to diastolic left ventricular dysfunction without major systolic dysfunction is significantly better than that of elderly patients with congestive heart failure and a low ejection fraction (8). It is also important to recognize the occasional elderly patient with high-output cardiac failure due to hyperthyroidism, anemia, arteriovenous fistula or Paget's disease, because these problems are often amenable to specific therapy.

Recognition of Heart Failure

The difficulty in the recognition of heart failure in the elderly is partly related to manifestations of coexisting respiratory, urinary tract and other diseases. The sedentary lifestyle of older patients, either because of habit or because of noncardiac disease, may mask or mimic manifestations of heart failure. Many of the symptoms of heart failure are the consequences of the compensatory mechanisms: tachycardia and vasoconstriction due to increased catecholamines, and sodium and water retention resulting in an expansion of the extracellular fluid volume. The clinical manifestations of these compensatory adjustments such as hypertension and edema may be absent or less prominent with chronic compensated heart failure.

Clinical Features

Dyspnea usually is the most prominent manifestation, commonly presenting as effort dyspnea, and often progressing to orthopnea, paroxysmal nocturnal dyspnea and pulmonary edema. However, dyspnea may also be a manifestation of myocardial ischemia—induced transient diastolic dysfunction rather than ventricular systolic failure. It is often

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difficult clinically to differentiate cardiac from pulmonary causes of excessive breathlessness before the development of pulmonary congestion or nocturia. Pulmonary dyspnea may reflect impaired ventilation secondary to chronic bronchitis and emphysema. Also, Cheyne-Stokes respiration may be erroneously perceived as episodic shortness of breath. Prominent ventilatory limitation to exercise may be demonstrated at an exercise test monitoring respiratory gas exchange; patients with this problem may develop hypoxemia or attain a level of ventilation that represents a major portion of their maximal voluntary ventilation at the time they experience breathlessness.

Easy fatigability, weakness and activity limitation are common but nonspecific manifestations of a reduced cardiac output. Peripheral vasoconstriction may produce cold limbs, and increased circulating catecholamines may result in a feeling of anxiety. Reduced cerebral perfusion may lead to confusion, somnolence or other alterations in mental status or behavior.

Evidence of sodium and water retention includes weight gain, nocturia and gastrointestinal symptoms—loss of appetite, nausea, early satiety, abdominal discomfort or constipation. These gastrointestinal symptoms due to the insidious onset of right ventricular failure may draw attention away from the heart. Elevation of the jugular venous pressure points to a cardiac origin. There may also be cardiac enlargement, gallop sounds, hepatomegaly, edema, pleural effusion, ascites, pulsus alternans and Cheyne-Stokes respiration. However, isolated pedal edema is often noncardiac, related to venous insufficiency or local factors. Pulmonary rales are not a reliable sign of left heart failure because of the frequency of chronic pulmonary disease in the elderly.

No electrocardiographic (ECG) abnormality is characteristic of heart failure, but ECG abnormalities may suggest an underlying condition such as left ventricular hypertrophy or myocardial infarction.

Noninvasive Diagnostic Techniques

Noninvasive techniques for evaluating cardiac function have considerably improved the recognition of heart failure in the elderly. The chest X-ray film provides an assessment of the pulmonary vasculature and is particularly valuable in identifying pulmonary venous hypertension and coexisting pulmonary disease. Cardiac chamber size and function are best evaluated by the echocardiogram (9) or radionuclide angiocardiogram. Both may help distinguish between systolic and diastolic dysfunction of the left ventricle. Increased left atrial size with delayed atrial emptying suggests diastolic dysfunction. Radionuclide techniques can best help assess the response of left ventricular function to activity. However, the measurement of left ventricular systolic function does not correlate well either with symptomatic heart failure or with exercise capacity (10).

Exercise testing. Even in the absence of heart failure, the ability of some elderly people to perform a satisfactory exercise test may be limited by physical deconditioning or by associated peripheral vascular disease, degenerative joint disease and musculoskeletal and neurologic disorders. However, in an experienced laboratory a supervised, slowly incremental exercise test, with monitoring of oxygen uptake, carbon dioxide production, minute ventilation, ECG and blood pressure can detect the severity of chronic cardiac or circulatory failure, as well as monitor the progression of failure over time and its response to therapy (11,12). It can also differentiate ventilatory from circulatory causes of exertional dyspnea. The low level exercise test can be performed and tolerated by most elderly patients who can walk without difficulty.

This procedure can define: a) maximal oxygen uptake (13), b) anaerobic threshold, and c) the ventilatory response to exercise. Cardiocirculatory fitness is reflected by the maximal oxygen uptake. Maximal oxygen uptake and anaerobic threshold reflect the degree of cardiac or circulatory impairment and predict the patient's cardiac reserve or cardiac output response to exercise (14). Abnormalities of ventilatory response to exercise testing may identify pulmonary disease as a cause of exertional dyspnea; many patients thought to have exertional dyspnea secondary to heart disease may have coexistent and dominant pulmonary disease with an abnormal ventilatory response to exercise.

Management of Heart Failure

Indications. The goals of treatment in the elderly are identical to those in younger patients: improvement of cardiovascular performance, reduction of morbidity, increase in exercise tolerance (15) and a prolongation of life. Current indications for treating heart failure include the presence of symptoms that limit life-style and signs or symptoms that may herald premature death. In assessing the poor prognosis of patients with heart failure (16), age itself has not emerged as an independent prognostic factor. Mortality appears related to hemodynamic abnormalities, severity of left ventricular dysfunction and underlying disease responsible for of the heart failure. Improvements in indexes of cardiac function may favorably influence survival and morbidity. Recent data in a younger population (17) suggest a prolongation of survival when vasodilator therapy is added to digitalis and diuretics. Exercise tolerance objectively measures symptomatic status and one component of quality of life, but its relation to prognosis is unclear.

Response to drug therapy. There is little evidence that the elderly have a different qualitative response to drugs or develop increased side effects with drugs. However, quan-

titative differences in response are often evident. Age alone does not enhance sensitivity to drugs or reduce the benefits of therapy, but may require changes in drug dosage. Age has not been a factor distinguishing responders from nonresponders in most controlled trials of the treatment of heart failure in regard to improvement in exercise tolerance and hemodynamics, reduced symptomatology and morbidity (18). The major reason for adverse responses to drugs in the elderly relates to the presence of associated diseases that impair renal, gastrointestinal, pulmonary and autonomic nervous system function. Diminished renal function is usually present in the elderly even when the serum creatinine level is normal. These alterations, rather than age itself, account for the altered drug metabolism, disposition and responsiveness. Advanced age, however, mandates a careful assessment for the presence of associated diseases that may affect treatment choices. Elderly patients do not respond differently than younger individuals to nitroprusside, nitrates, hydralazine or angiotensin-converting enzyme inhibitors (19), but frequently require lower dosages. The likelihood of digitalis toxicity is not greater in an elderly population when proper adjustment in digitalis dosage is made for renal dysfunction, associated disease and the decreased volume of distribution. Elderly patients should be included in studies of experimental drugs currently being tested for the management of heart failure.

General management. The management of the elderly patient with heart failure involves identifying and eliminating precipitating factors. As with younger patients, it also includes attempts to improve left ventricular function, to optimize the loading conditions of the heart and to limit sodium and water retention. Conversion of atrial fibrillation or atrial flutter to sinus rhythm may augment the cardiac output. Therefore, the cornerstones of management include recommendations for appropriate levels of physical activity, monitoring of daily weight, administration of digitalis to improve left ventricular function when systolic function is impaired, diuretic and vasodilator therapy to optimize loading conditions and decreased sodium intake to limit fluid retention. Arterial dilator drugs may be advantageous in decreasing left ventricular stress and venodilators reduce ventricular filling pressures. However, treatment of heart failure due predominantly to diastolic dysfunction with venodilator drugs and diuretics alone may be disadvantageous because these agents reduce ventricular filling volume and may thereby reduce cardiac output. Digitalis therapy is indicated in elderly patients with moderate or severe heart failure, even with sinus rhythm, particularly when cardiomegaly and low cardiac output are present; improvement in ejection fraction usually occurs, even with relatively low serum digoxin concentrations (20). Digitalis has marginal benefit in elderly patients who have mild congestive heart failure, a high ventricular ejection fraction and sinus rhythm. The use of calcium blocking drugs to treat left ventricular failure remains controversial; hazards include depression of left ventricular function and bradycardia, and other arterial dilators are available that produce better results (21).

Side effects of treatment. Excessive immobilization may predispose to thromboembolism. Excessive diuresis should be avoided because it may limit cerebral perfusion, cause confusion and further impair renal function, and it can be associated with hypokalemia, which may cause arrhythmias that further worsen heart failure. Digitalis has a narrow therapeutic margin; bradycardia or AV block, or both, is commonly accentuated by the concomitant use of beta-blocking agents, reserpine or calcium blocking drugs. Quinidine may increase serum digoxin levels and induce atrial or ventricular tachyarrhythmias, or both, due to digitalis excess. Vasodilator drugs often produce postural hypotension.

Patient compliance. The elderly population, as a whole, is compliant with drug therapy, possibly related to their increased need for medical treatment and the availability of medical care. They do not appear to differ from younger patients in taking medications as prescribed, following recommendations and maintaining follow-up, all of which enhance the chances for successful treatment. Detailed, preferably written, instructions about medications are needed.

Rehabilitation. Psychologic and rehabilitative support are important components of therapy. Improvement in exercise capacity can reasonably be expected after treatment of heart failure in the elderly, and exercise training can further improve exercise tolerance and may improve the quality of life. The favorable training response relates primarily to peripheral circulatory and skeletal muscle adaptations, rather than to a change in myocardial function. A rational exercise training regimen for elderly patients can be based on data obtained at exercise testing.

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